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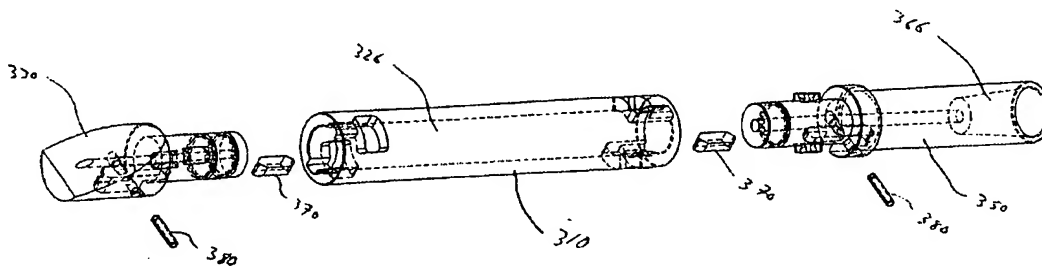
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(54) Title: CONNECTION ASSEMBLY FOR DIRECTIONAL DRILLING



(57) Abstract: Drill stem elements and connections are shown with advantages such as being mechanically robust. The absence of a side access window in a sonde housing is one design feature that provides robust mechanical properties. Further advantages of the sonde housings include being easy to disassemble for access to the sonde unit, or for insertion of the sonde unit. In one embodiment, a cap portion is easily secured or removed using a small allen wrench, or a hammer and a punch. The cap portion is not substantially affected or tightened by rotation of the drill stem during a drilling operation. A further advantage includes the ability to remove cap portions and pull back flexible product such as polyethylene pipe from a small exit pit.

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INTERNATIONAL SEARCH REPORT

International Application No

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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E21B17/046 F16L37/14 F16L37/252 E21B7/06 E21B10/62
E21B10/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E21B F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 664 444 A (HENSON WILLIAM P) 23 May 1972 (1972-05-23)	1-3, 9, 11-14, 17, 18, 30-32
Y	column 1, line 41 - line 47; figure 2 column 1, line 58 - line 68	19, 25-28, 34-36
X	----- US 4 611 662 A (HARRINGTON JOHN P) 16 September 1986 (1986-09-16)	1, 2, 6, 7, 9, 10, 12-16
Y	column 2, line 61 - column 3, line 45; figure 1 ----- -/--	26, 28

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 102 135 A (SHAW NEIL B) 15 August 2000 (2000-08-15) column 1, line 50 - line 54; figures 1,2 column 2, line 43 - column 3, line 15 -----	1,2,4-7, 9
X	US 4 986 690 A (COOKSEY ANDREW G) 22 January 1991 (1991-01-22) see abstract figure 2 -----	1-6,8,9
Y	-----	19,27
Y	US 5 242 026 A (SEWELL CODY L ET AL) 7 September 1993 (1993-09-07) -----	25-28
X	column 6, line 9 - line 52; figures 2,10,11,27 column 7, line 66 - column 8, line 2 column 10, line 52 - line 60 -----	21-24
Y	US 2002/043408 A1 (CRANE ROBERT F ET AL) 18 April 2002 (2002-04-18) -----	34-36
A	paragraph '0009! - paragraph '0012!; figures 1,23 -----	21
A	US 6 170 570 B1 (AGUESSE LAURENT J ET AL) 9 January 2001 (2001-01-09) See abstract column 2, line 28 - line 37; figures 1,4 -----	1,12,17, 25,30
A	US 5 253 721 A (LEE DOUGLAS W) 19 October 1993 (1993-10-19) figure 3 -----	21
A	US 5 469 926 A (LESSARD WILLIE J) 28 November 1995 (1995-11-28) claim 1; figures 1,4 -----	21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2004/000924

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/SA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-20,25-36

A drill stem connection assembly with engaging and mating features including a securing member

2. claims: 21-24

A tool holder assembly comprising :
a connection portion;
a drilling blade mounting surface;
a fluid channel;
a replaceable nozzle receptacle; and
a replaceable nozzle

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2004/000924

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3664444	A	23-05-1972	NONE
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